



UNITED STATES PATENT AND TRADEMARK OFFICE

UNITED STATES DEPARTMENT OF COMMERCE
United States Patent and Trademark Office
Address: COMMISSIONER FOR PATENTS
P.O. Box 1450
Alexandria, Virginia 22313-1450
www.uspto.gov

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/711,700	09/30/2004	Kevin S. Petrarca	FIS920040258US1	5699
32074 7590 12/16/2008 INTERNATIONAL BUSINESS MACHINES CORPORATION DEPT. 18G BLDG. 300-482 2070 ROUTE 52 HOPEWELL JUNCTION, NY 12533			EXAMINER NGUYEN, TRAM HOANG	
			ART UNIT 2818	PAPER NUMBER
			MAIL DATE 12/16/2008	DELIVERY MODE PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary	Application No. 10/711,700	Applicant(s) PETRARCA ET AL.	
	Examiner TRAM H. NGUYEN	Art Unit 2818	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 28 August 2008.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,4,5,13 and 15 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,4-5,13,15 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Response to Arguments

Applicant's arguments with respect to claims 1,4-5,13,15 have been considered but are moot in view of the new ground(s) of rejection.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1,4-5,13,15 rejected under 35 U.S.C. 103(a) as being unpatentable over Andricacos et al. (US 6,709,562; hereinafter Andricacos) and further in view of Noriyoshi et al. (JP 11-297696; hereinafter Noriyoshi)

Regarding **claim 1**, Andricacos discloses a copper interconnect (fig. 6) comprising:

a copper seed layer (reference numeral 5) is deposited on a barrier layer (reference numeral 4), said barrier layer (4) prevents substantial diffusion of copper through to an underlying insulating layer (reference numeral 1), said barrier layer (4) prevents substantially diffusion of copper through to an underlying insulating layer (1).

Andricacos does not explicitly teach the impure copper seed layer derived from a first impure copper source.

Noriyoshi teaches a similar copper interconnect structure (see fig. 1B- 1C and 2B) wherein the copper seed layer (7) contains Sn 0.5 % of the weight as impurity (see Noriyoshi's Specification in English translation: par.[0021] and fig. 1B).

Therefore, it would have been obvious to one having ordinary skills in the art at the time the invention was made to include the impure copper seed layer derived from a first impure copper source as taught by Noriyoshi in the copper interconnect as disclosed by Andricacos so that it forms a high electromigration-resistance Cu wiring having a high adhesion to the base surface (see Noriyoshi's Abstract).

Fig. 6 of Andricacos teaches an impure copper fill (reference numeral 6) derived from an impure copper source (6) with a content of impurities (see col. 2, lines 60-67) that fills an opening in said underlying insulating layer (1) and on said impure copper seed layer (5).

Art Unit: 2818

The combination of Andricacos and Noriyoshi teaches the material composition of the impure copper seed layer (Note: the copper seed layer 7 in Noriyoshi “contains Sn 0.5% of the wt as the impurity” as recited from par.[0021]) is substantially the same as material composition of said impure copper fill (Note: in col. 2, lines 60-67 of Andricacos exhibits that the impure copper fill contains a small amounts of a materials in the Cu selected from the group consisting of C (less than 2 wt %), O (less than 1 wt %), N(less than 1wt %), S (less than 1wt %) and C1 (less than 1 wt %)) except some impurities in the impure copper fill are absent from the impure copper seed layer (refer to the copper seed layer 7 of Noriyoshi).

The limitation “as a consequence of deposition of the impure copper seed layer” refers to a product by process claim is directed to the product per se, no matter how actually made, In re Hirao, 190 USPQ 15 at 17 (footnote 3). See also In re Brown, 173 USPQ 685; In re Luck 177 USPQ 523; In re Fessman 180 USPQ 324; In re Avery 186 USPQ 161; In re Wertheim 191 USPQ 90; and In re Marosi et al 218 USPQ 289, all of which make it clear that it is the patentability of the final product per se which must be determined in a “product by process claim, and not the patentability of the process, and that an old product produced by a new method is not patentable as a product, whether claimed in “product by process claims or not. Note that applicant has the burden of proof in such cases, as the above caselaw makes clear.

Noriyoshi teaches said first content of impurities of said first impure copper source of said impure copper seed layer comprises not more than 1.20% by weight and

Art Unit: 2818

not less than or equal to 0.001% by weight (see Noriyoshi's Specification in English translation: par.[0021]), and,

Andricacos teaches said second content of impurities of said second impure copper source of said impure copper fill comprises not more than 1.20% by weight and not less than or equal to 0.001% by weight (see Andricacos: col. 2, lines 60-67).

Regarding **claim 4**, Andricacos and Noriyoshi disclose all the limitations of the claimed invention for the same reasons are set-forth above. Besides, the combination of Andricacos and Noriyoshi teaches the material composition of the impure copper seed layer (Note: the copper seed layer 7 in Noriyoshi contains Sn 0.5% of the wt as the impurity as recited from par.[0021]) is substantially the same as material composition of said impure copper fill (Note: in col. 2, lines 60-67 of Andricacos exhibits that the impure copper fill contains a small amounts of a materials in the Cu selected from the group consisting of C (less than 2 wt %), O (less than 1 wt %), N(less than1wt %), S (less than1wt %) and C1 (less than1 wt %))

Regarding **claim 5**, Andricacos And Noriyoshi disclose all the limitations of the claimed invention for the same reasons are set-forth above. Besides Noriyoshi teaches the material composition of the impure copper seed layer (7) contains Sn 0.5% of the wt as the impurity (par.[0021] of Noriyoshi). Andricacos exhibits that the impure copper fill contains a small amounts of a materials in the Cu selected from the group consisting of C (less than 2 wt %), O (less than 1 wt %), N(less than1wt %), S (less than1wt %) and Cl (less than1 wt %) (in col. 2, lines 60-67 of Andricacos)

Regarding **claim 13**, Andricacos discloses a copper interconnect (fig. 6) comprising: an insulating layer (1) that has an opening; a barrier layer (4) that prevents substantial diffusion of copper through to said underlying insulating layer that is deposited on said underlying insulating layer (1) and lines said opening (see fig. 6); an copper seed (5) deposited on said barrier layer (4) and fills said opening (see fig. 6).

Andricacos does not explicitly teach the impure copper seed layer derived from a first impure copper source.

Noriyoshi teaches a similar copper interconnect structure (see fig. 1B- 1C and 2B) wherein the copper seed layer (7) contains Sn 0.5 % of the weight as impurity (see Noriyoshi's Specification in English translation: par.[0021] and fig. 1B).

Therefore, it would have been obvious to one having ordinary skills in the art at the time the invention was made to include the impure copper seed layer derived from a first impure copper source as taught by Noriyoshi in the copper interconnect as disclosed by Andricacos so that it forms a high electromigration-resistance Cu wiring having a high adhesion to the base surface (see Noriyoshi's Abstract).

Fig. 6 of Andricacos shows an impure copper fill (reference numeral 6) derived from an impure copper source with a content of impurity (see col. 2, lines 60-67) that fills said opening in said underlying insulating layer (1) that is deposited on said impure copper seed (5).

The combination of Andricacos and Noriyoshi teaches the material composition of the impure copper seed layer (Note: the copper seed layer 7 in Noriyoshi "contains

Art Unit: 2818

Sn 0.5% of the wt as the impurity” as recited from par.[0021]) is substantially the same as material composition of said impure copper fill (Note: in col. 2, lines 60-67 of Andricacos exhibits that the impure copper fill contains a small amounts of a materials in the Cu selected from the group consisting of C (less than 2 wt %), O (less than 1 wt %), N(less than 1wt %), S (less than 1wt %) and C1 (less than 1 wt %)) except some impurities in the impure copper fill are absent from the impure copper seed layer (refer to the copper seed layer 7 in Noriyoshi).

The limitation “as a consequence of deposition of the impure copper seed layer” refers to a product by process claim is directed to the product per se, no matter how actually made, In re Hirao, 190 USPQ 15 at 17 (footnote 3). See also In re Brown, 173 USPQ 685; In re Luck 177 USPQ 523; In re Fessman 180 USPQ 324; In re Avery 186 USPQ 161; In re Wertheim 191 USPQ 90; and In re Marosi et al 218 USPQ 289, all of which make it clear that it is the patentability of the final product per se which must be determined in a “product by process claim, and not the patentability of the process, and that an old product produced by a new method is not patentable as a product, whether claimed in “product by process claims or not. Note that applicant has the burden of proof in such cases, as the above caselaw makes clear.

Noriyoshi teaches said first impurity content of said impure copper seed layer comprises not more than 1.2% by weight and not less than or equal to 0.001% by weight (Note: the copper seed layer 7 in Noriyoshi “contains Sn 0.5% of the wt as the impurity” as recited from par.[0021]).

Noriyoshi teaches said impurity content of said impure copper seed source comprises not more than 1.20% by weight and not less than or equal to 0.001% by weight of said impure copper seed layer (Note: the copper seed layer 7 in Noriyoshi “contains Sn 0.5% of the wt as the impurity” as recited from par.[0021]), and,

Andricacos teaches said impurity content of said impure copper source comprises not more than 1.20% by weight and not less than or equal to 0.001% by weight of said impure copper fill (Note: in col. 2, lines 60-67 of Andricacos exhibits that the impure copper fill contains a small amounts of a materials in the Cu selected from the group consisting of C (less than 2 wt %), O (less than 1 wt %), N(less than1wt %), S (less than1wt %) and C1 (less than1 wt %).

Regarding **claim 15**, Andricacos discloses all the limitations of the claimed invention for the same reasons are set-forth above. Besides Noriyoshi teaches the material composition of the impure copper seed layer (7) contains Sn 0.5% of the wt as the impurity (par.[0021] of Noriyoshi).

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within

Art Unit: 2818

TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Tram Hoang Nguyen whose telephone number is (571) 272-5526. The examiner can normally be reached on 8:30am-5:00pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Steven Loke can be reached on (703)872-9306. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

Application/Control Number: 10/711,700

Page 10

Art Unit: 2818

**/Tram H Nguyen/
Examiner, Art Unit 2818**

**/DAO H NGUYEN/
Primary Examiner, Art Unit 2818
December 11, 2008**